

# **RALEY'S LNG TRUCK FLEET**

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**START-UP EXPERIENCE**



*Raley's*



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**ALTERNATIVE FUEL TRUCK  
EVALUATION PROJECT**

On April 16, 1997, Raley's Supermarkets and Drug Centers introduced California's first commercial fleet of trucks fueled by liquefied natural gas (LNG). This report outlines how Raley's introduced LNG trucks into its fleet. A detailed report on the performance of the trucks will be published after the trucks' first year of service.

Raley's, headquartered in West Sacramento, California, has 87 supermarkets and drug centers throughout Northern California and Northern Nevada. Recently recognized by Consumer Reports as one of the top grocery chains in the United States, Raley's is

## ***Raley's is a Clean Air Leader in the Business Community***

On May 2, 1997, the American Lung Association honored Raley's for being the first business in California to use vehicles fueled by liquefied natural gas in its transportation and distribution network. Raley's has also constructed an on-site fueling station that is available to the public, opening opportunities for fleet owners and operators in the area to follow Raley's clean air lead.

"It would have been easy for Raley's to continue their established method of retiring, purchasing, and fueling diesel-powered trucks and tractors," said Lung Association President Tom Donnelly, M.D. "There is no adopted or pending legislation which requires Raley's to adopt LNG technology. Yet, because Raley's is a conscientious corporate citizen, they opted to install this costly clean air upgrade for the benefit of the entire community."

Source: American Lung Association of Sacramento-Emigrant Trails



a privately held company with more than 11,000 employees.

Raley's 48-truck fleet now includes eight LNG-fueled tractor-semitrailer trucks (called "Clean Air Machines") and two LNG-fueled yard tractors. Raley's line-haul trucks distribute perishables from the grocery chain's 337,870-square-foot distribution center to its stores in California and Nevada. The LNG fleet is used for local routes and operates 16 hours a day, 5 to 6 days each week. Stan Sasaki, manager of transportation for the distribution center, is incorporating the trucks into the center's daily local routes. "I don't intend to treat these trucks any differently," he says. "They are part of my fleet and they need to be on the road."

Raley's leases its trucks from fleet owner Ozark Trucking, also located in West Sacramento. Ozark manages all tractor and trailer maintenance for Raley's. The move to add the LNG-fueled vehicles came as no surprise to Ed Gamache, Ozark's fleet maintenance manager. "Raley's is so environmentally conscious that this just fell in line with their beliefs," he said, referring to the significant number of environmental programs Raley's incorporates into its daily operations and the awards the chain has received.

Using alternative fuel vehicles appealed to Kathleen Tschogl, manager of environmental and regulatory affairs and one of the creators of Raley's numerous recycling and

energy-awareness programs. More than 12 months ago, Tschogl, who also manages the LNG venture, began discussing the idea with Tim Taylor, director of the Mobile Source Division at the Sacramento Metropolitan Air Quality Management District (SMAQMD). Taylor worked with Tschogl to frame the program and develop the action plan. Tschogl emphasizes Raley's corporate commitment to the project. "Sometimes the excitement about wanting to do something like this gets caught up with bottom-line issues, and nothing happens," Tschogl

says. Raley's made it happen, according to Tschogl, "because we see this as a community effort. We want to be seen as a leader in using this technology."

But introducing the vehicles into the fleet meant satisfying the operational and maintenance requirements of Stan Sasaki and Ed



Gamache. "We examined all of the choices for fuels and kept coming back to the issue of range," says Sasaki. "We chose LNG to meet the needs of our routes."

LNG is also relatively safe to use because its flammability is limited and because it is non-toxic and non-carcinogenic. LNG does not present a threat to soil, surface water, or ground water. LNG fuel tanks are smaller and lighter than compressed natural gas (CNG) cylinders for the same

These pollutants are of major concern in urban areas across the country.

Given these considerations, Raley's chose LNG. With help from Cummins West and the SMAQMD, Raley's began evaluating the requirements for using LNG in heavy-duty trucks.

According to Tschogl, using LNG in 20 percent of the Raley's fleet will replace about 100,000 gallons of diesel each

engine comparable to Cummins diesel engines. The Cummins L10-300G lean-burn engine uses charge air cooling to lower intake manifold temperatures and to improve fuel mileage and reduce emissions levels. The lean-burn technology results in low carbon monoxide, particulate matter, reactive hydrocarbons, and oxides of nitrogen, and also in high thermal efficiency. Cummins engineers began working with



**NREL**

## *Program Will Evaluate LNG Fleet Operations*

In May 1997, Raley's agreed to participate in the National Renewable Energy Laboratory's (NREL) Alternative Fuel Truck Evaluation Project. Battelle, NREL's support contractor for this project, will collect operational data from Raley's for 12 months and analyze the data. A technical report will document the operation of the trucks so other fleet operators can make informed decisions about adding similar trucks to their fleets.

NREL's report on the cost, reliability, fuel economy, and emissions of Raley's LNG fleet will be available in 1998 from the National Alternative Fuels Hotline (1-800-423-IDOE).

vehicle range. In addition, LNG's simpler chemical composition makes it an inherently cleaner burning fuel than conventional diesel fuel. Natural gas engines have substantially reduced emissions of oxides of nitrogen and particulate matter compared to current diesel engines.

year, and produce about 5 tons less of oxides of nitrogen annually.

To meet the range requirements of the distribution routes and the power needs of the terrain, Raley's and Ozark selected Kenworth trucks with Cummins engines. Cummins has developed an efficient commercial natural gas

natural gas because they consider it to be one of the best alternative fuels available.

Cummins worked with Kenworth Truck Company to develop the LNG truck. Kenworth has produced 19 of these tractors since beginning the program in February 1996.

## LNG is an Environmentally Friendly Fuel

Natural gas consists primarily of methane, with other hydrocarbon gases such as ethane, propane, and butane. Natural gas includes trace amounts of carbon dioxide, nitrogen, and water. Cooling natural gas to approximately -260°F at atmospheric pressure condenses the gas to liquefied natural gas (LNG). LNG, which must be cold to remain liquid, is stored in double-wall, vacuum-insulated containers.

LNG is colorless, odorless, non-toxic, non-corrosive, and non-carcinogenic. LNG is burned as a gas when used as a fuel, and it can provide significant reductions in carbon monoxide, reactive hydrocarbons, particulate matter, and oxides of nitrogen. Natural gas has an octane rating of 130 and excellent properties for spark-ignited internal combustion engines.

Source: MVE, Inc., and NREL

### Kenworth T800 Specifications

- Class 8 tractor
- 112-inch length bumper to back of cab
- 80,000-pound gross vehicle weight



# KENWORTH

Specially developed gauges in the cab monitor the LNG fuel level and a methane detector alerts drivers in the event of a fuel leak. Raley's drivers like the quiet, odorless engines, although they are still trying to get used to the lack of noise.

The on-board LNG fueling system for the trucks includes two 87-gallon MVE saddle tanks (174-gallon total or 104 diesel energy equivalent gallons). The inner and outer vessels of the tank

are lightweight, durable, corrosion-resistant stainless steel. The tanks have a maximum allowable working pressure of 230 psi, and the operating pressure range is 50 to 150 psi. The factory setting is 70 psi.

Raley's chose on-site fueling, primarily because of the number of trucks it added to the fleet.

The fueling occurs at an MVE Quick Response Station (QRS™) at the Raley's Distribution Center. MVE designed the QRS as a



temporary station for fueling LNG vehicles. The QRS

enables a new LNG fleet customer to fuel 2 to 30 vehicles while a permanent station is under construction. A jointly designed MVE/Drexel permanent fueling station will be completed by the end of 1997.

The QRS system transfers, conditions, meters, and dispenses LNG. A gas detection system uses a monitored detector, providing a local alarm and





automatic emergency shut-down capability.

Because LNG is a relatively new fuel, start-up operations can require an initial capital investment to build the infrastructure necessary for safe, efficient operations. As Sasaki points out, realizing the return on the investment requires more than one truck

because of the infrastructure requirements (such as the fueling station). Sasaki also recognizes that using the trucks effectively requires a long-term commitment. "We are in for the long haul," he says. "If you are going to do

it, then do it. We are giving ourselves time to make this work." Tschogl agrees, indicating that Raley's expects the investment to balance out in about seven years.



Assistance from the SMAQMD enabled Raley's to build the fueling station.

The LNG fleet services stores in or around Sacramento, which is within a federal ozone non-attainment area. The six-county area is designated as non-compliant with federally established ozone standards. In addition to providing technical expertise, the SMAQMD uses a number of financial incentives to persuade fleet owners to move toward clean-burning fuels.

The SMAQMD distributes funds from its On-Road Low-Emission Heavy-Duty Vehicle Program to projects that will reduce oxides of nitrogen emissions from on-road heavy-duty vehicles through the accelerated introduction of low- and reduced-emission technologies. SMAQMD

Fuels Hotline, 1-800-423-1DOE) contains information on how and where to obtain funding for Clean Cities use.

The Congestion Mitigation and Air Quality (CMAQ) Improvement Program also funds projects. CMAQ projects must be coordinated

S P E C I F I C A T I O N S	
 	<b>Cummins L10-300G</b> <ul style="list-style-type: none"> <li>■ LNG fuel</li> <li>■ 6-cylinder</li> <li>■ spark-ignited</li> <li>■ 10.5:1 compression ratio</li> <li>■ rated horsepower of 300 at 2100 rpm</li> <li>■ rated torque of 900 lb-ft at 1300 rpm</li> </ul>
	<b>Cummins M11-330</b> <ul style="list-style-type: none"> <li>■ diesel fuel</li> <li>■ 6-cylinder</li> <li>■ compression-ignited</li> <li>■ 16.1:1 compression ratio</li> <li>■ rated horsepower of 330 at 1600 rpm</li> <li>■ rated torque of 1250 lb-ft at 1200 rpm</li> </ul>

granted Raley's \$600,000 to fund the construction of the temporary fueling station at the distribution center and to offset the higher cost of the LNG trucks.

Several funding sources are available to companies considering alternative fuels. In addition, there are federal, state, and local tax incentives available for conversion to LNG fuel. For example, the U.S. Department of Energy's Clean Cities Program is a government/industry partnership that emphasizes local involvement. The *Clean Cities Guide to Alternative Fuel Vehicle Incentives and Laws* (available at <http://www.afdc.doe.gov> or from the Alternative

through an area's metropolitan planning organization, which is the key agency for transportation planning in urban areas. The Gas Research Institute funds natural gas projects, and many states also have funding available.

Raley's hopes that its "lessons learned" will benefit others. The Raley's experience has resulted in some key guidelines for other decision makers contemplating the addition of alternative fuel vehicles to their fleets:

- Corporate commitment is essential. The benefits of converting to alternative fuels will not be immediately and universally obvious. The program needs a champion who is committed to working through the problems that arise.

■ It takes creative, forward-looking thinking to undertake a project like this, but it also requires the same kind of thinking to keep it going. Hurdles will present themselves, and there are no easy, proven answers—it

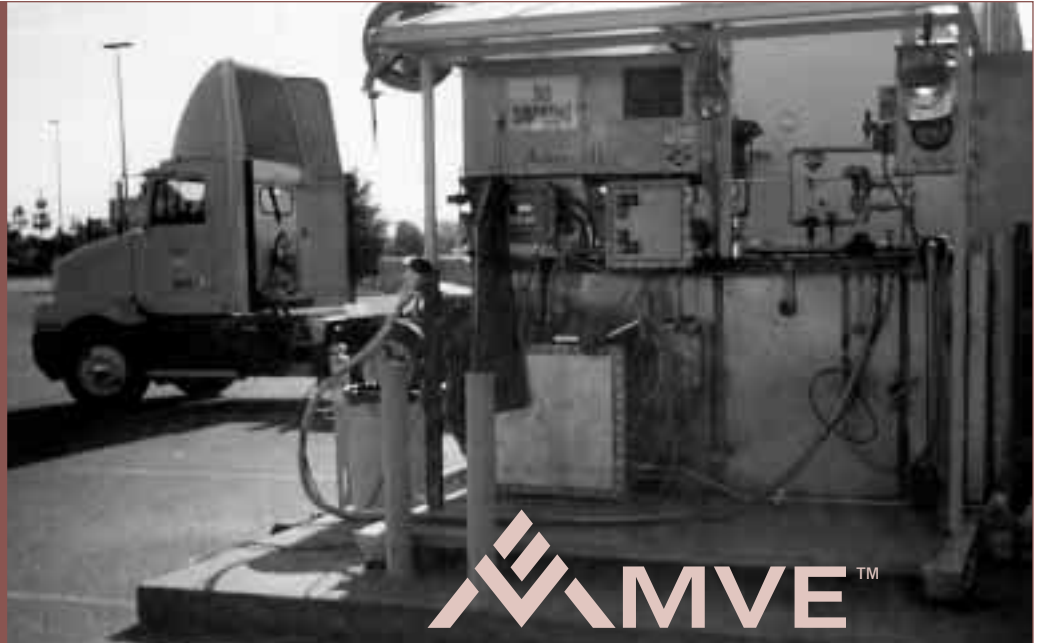
hasn't been done, so it's up to you to find the answers.

■ Some problems may seem insurmountable at first because there is no precedent. Fueling has been the single most troublesome

aspect of Raley's start-up experience. In this respect, Raley's has dealt with both infrastructure and permitting issues, most of which resulted from the newness of the technology. Community education may be necessary

## MVE QRS Specifications

- Consists of a horizontal 6000-gallon LNG storage tank, a separate vacuum-insulated chamber that contains a submerged LNG pump and meter, and a heat exchanger for saturation control
- Packaged in an 8 foot, 6 inch wide by 10 foot, 6 inch high by 40 foot long-framed skid that can be transported by truck
- Computer-controlled
- Fill rates of 30 to 50 gallons per minute



## SMAQMD Offers Various Programs to Reduce Emissions

*The goal of the SMAQMD Mobile Source Division is to significantly reduce emissions from on-road and off-road mobile sources in accordance with the requirements of the California Health and Safety*

*Code and the commitments made in the Ozone Attainment Plan. Emissions are reduced through various technologies, transportation demand management, and community education programs.*

### Examples of the SMAQMD programs include:

- On-Road Medium-Duty and Heavy-Duty Vehicle Program
- On-Road Light-Duty Vehicle Program
- Off-Road Program
- Alternative Fuel Infrastructure.

before operational permits can be secured.

- Learning about the fuel builds a good foundation for decision making. Such knowledge dispels fears about new technology, which in turn eliminates boundaries. Make use of experts. With the assistance of the SMAQMD, Raley's sponsored a session to teach its personnel the general principles about LNG fuel. This "LNG 101" class instilled confidence in Raley's staff—both for speaking about the fuel and working with it in daily operations.
- Comprehensive operating and safety training is essential. LNG requires handling procedures that are different from conventional diesel fuel, and fuelers, drivers, and other personnel

who will be working closely with the fuel must understand how to deal with it.

■ An alternative fuel program offers a tremendous opportunity to educate the general public about the benefits of its use, and also about the company sponsoring the program. Such a highly visible program requires an educated staff that can speak about the fuels. Raley's recognized that its drivers and the trucks were the central ambassadors for the LNG program. They provided the drivers with shirts and hats bearing the same logo that graced the tractors—a professionally designed image of white clouds lofting against a sky blue background, conveying the environmental message central to LNG use.

■ It's important to know the regulations in the area of operation. In the State of California, Title 13 of the California Code of Regulations specifies minimum standards for safety for vehicles operating on state roads. Although Kenworth built the trucks to meet the specifications of Sections 935 and 936, the LNG trucks have been exempted from certain requirements. To avoid problems associated with the still unfamiliar trucks and their saddle tanks on California roads, each vehicle carries a letter from the California Highway Patrol that articulates the exemptions. Knowing the permitting requirements in the community is also essential. You may need to address building codes, safety and fire regulations, and other handling requirements.

Although LNG has been used for a very long time, to many it is a new fuel. Recognizing that the permitting process may be a new experience for both you *and* the permitting agency will make the task a little easier.

■ Raley's found that a team approach facilitated the start-up operation. The team included personnel from all parts of the company—drivers, maintenance, operations, safety, and corporate. The team also needs to include key participants from outside the company. Having designated representatives available from the engine, truck, and fuel station manufacturers during the critical start-up phase will make problem solving and troubleshooting easier.

■ The initial development process will be difficult. Unfamiliar problems are inevitable,

but not insurmountable. Tom Swenson, manager of clean technology programs for the SMAQMD, offers some simple advice: "Be patient. Have realistic expectations. Ask for help."

The Raley's experience proves that commitment to the project is the key. "Do it for the benefit of air quality," Kathleen Tschogl says. "The bottom-line benefit will follow."



## The Alternative Fuel Truck Evaluation Project

The Alternative Motor Fuel Act of 1988 requires the U.S. Department of Energy (DOE) to demonstrate and evaluate alternative fuels usage in the United States. DOE's National Renewable Energy Laboratory (NREL) is conducting the Alternative Fuel Truck Evaluation Project to compare alternative fuel and diesel fuel trucks. Information for the comparison comes from data collected on the operational, maintenance, performance, and emissions characteristics of alternative fuel trucks currently being used in vehicle fleets and comparable diesel fuel trucks serving as controls within the same fleet. In 1993, NREL began a similar program to evaluate transit bus use. The defined and proven data collection and analysis system from the bus study is being adapted for the heavy truck project. The sites in the program are selected according to the type of trucks and engines used, the availability of control vehicles, and site interest in participating. Specific criteria must be met, such as vehicle class (Class 6, 7, or 8 trucks with a gross vehicle weight of at least 19,500 pounds) and number of alternative fuel trucks (at least five).

This report highlights the start-up experience of the project's first demonstration site, the Raley's Distribution Center in Sacramento, California. In a few months, a second report will update Raley's progress in operating the trucks. At that time, preliminary data about vehicle operations may be available. After collecting 12 months of data from the site, NREL and Battelle, NREL's support contractor for the project, will prepare a formal report and analysis. If you want to know more about this LNG truck program, its components, alternative fuel vehicles, or incentive programs, contact any of the following:

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For more information and for copies of program reports, visit the Alternative Fuels Data Center on the World Wide Web at <http://www.afdc.doe.gov>, or call the Alternative Fuels Hotline at 1-800-423-1DOE.

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